The meanings of science: conversations with geneticists

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The question of the possible impact of the discoveries made in genetics on the concept of being human has been explored by a number of humanities scholars and social theorists (Habermas 2003, Derrida 2002, Baudrillard 2000, Fukuyama 2002), who have expressed concern about the science of genetics and technologies arising out of it providing a biological reductionist definition of the human or forcing societies to accept a fixed definition of the human in their legislation. Anthropologists and social scientists have argued that genetic technology is causing a change in the way we conceptualise ourselves and essentialise our identity (Franklin 1993, Lippman 1993, Brodwin 2002). It has been also observed that the Human Genome Project (HGP) was portrayed both in scientific and popular literature as a solution to the mysteries of life itself (Haraway 1997, Holmberg 2005). But is this view shared by the primary providers of the knowledge of genetics and genomics, i.e. relevant scientists themselves? Various terms and concepts emanating from life sciences appear to have taken on a life of their own in the public discourse as reflected in the surveys of public opinion, mass media, literature, film and even visual art (Nelkin and Lindee 2004, Van Dijck 1998). Do scientists have any fixed views of the cultural meanings of genetics?

The mass media and popular scientific literature often create an impression of scientists directing public opinion towards a reductionist understanding of the implications of life sciences for the concepts of being human (Nelkin and Lindee 2004). Some distinguished molecular biologists themselves have contributed considerably to this image. Thus James Watson has mentioned that Francis Crick was right when he announced in the Eagle pub that they had discovered the 'secret of life'(Watson 2003: xix) (though the latter argued in his autobiography that he did not remember it (Crick 1988: 77)). In the same book Watson observes that the Human Genome Project was not just 'an extraordinary technological achievement', but also 'a landmark in terms of our idea of what it is to be human', as, according to him, 'it is our DNA that distinguishes us from all other species, and that makes us creative, conscious, dominant, destructive creatures that we are' (Watson 2003: xxi-xxii). Another distinguished molecular biologist

and a Nobel laureate Walter Gilbert suggested that the HGP will cause significant changes in human self-perception: 'To recognize that we are determined, in a certain sense, by a finite collection of information that is knowable will change our view of ourselves. It is a closing of an intellectual frontier, with which we will have to come to terms' (Gilbert 2000: 96). How wide-spread are such claims which may be interpreted as reductionist among geneticists and molecular biologists? Does everybody in this profession ascribe their branch of science this very special meaning?

This paper explores the responses of scientists from the UK, Russia, France and the USA to questions about the cultural and conceptual implications of genetics. It is based on eighteen semi-structured in-depth interviews which were conducted from December 2004 to May 2005 and in March 2006. All interviewees are senior scientists working at well-established departments/schools/institutes of genetics or molecular biology. Half of them are scientists involved in basic research and university teaching and the other half are medical geneticists involved both in basic research and clinical practice.

The interviewees were asked a number of questions inviting them to reflect on the conceptual implications that genetics had had or might have on general culture. The interview included the following questions: Would you say that discoveries made in genetics since Mendel have affected the concept of being human (at least in 'Western' culture) and, if yes, how? Have they in any way affected 'our' worldviews? Why do you think we hear so much about genetics in the mass media? Is there anything special about genetics in terms of the way people relate to it as opposed to other natural sciences, including other life sciences?

The received answers were rather diverse. Many of them distinguished between the implications of the science of genetics per se and of the technology stemming from it. As far as the former is concerned most of the interviewees mentioned genetics demonstrating that there was a lot in our nature that was beyond our control and several scientists specified that the real conceptual revolution was brought by Mendel whose work cast light on the mechanisms of heredity, a question which had always been extremely important in many societies. As one interviewee put it, 'inheritance is a very powerful part of any individual's own view of themselves' and hence people tended to

find the idea that by looking at their DNA it was possible to make some predictions about their future both attractive and frightening.

At the same time, practically each person qualified his or her response in such a way so that to avoid sounding too deterministic. One interviewee argued that though the cultural importance of the knowledge of inheritance that genetics gave the world was impossible to overestimate because heredity was one of the most fundamental concepts pertinent to the understanding of what it means to be human, geneticists were 'moving away from being deterministic' as the importance of epigenetic factors was becoming more and more apparent particularly after the completion of the HGP. She also argued that sometimes geneticists themselves were guilty of playing up the social importance of genetics in front of the public for fund-raising purposes. Another person said that it was obvious that some features were predetermined and hence it was important to develop genetic engineering to correct the 'mistakes of nature', but it had to be confined to purely therapeutic purposes and combined with changes in environment whose influence was at least as important as that of the genes. Another scientist also observed that genetics was not as highly predictive as people used to think. Only one respondent observed without hesitation that 'genetics is very much about a person's identity; along with those parts of their identity, which a person cannot alter as easily as they wish by external factors'.

Every interviewee was asked to compare the conceptual impact of genetics to that of the Darwinian revolution. Everyone argued that the former was hardly as important as the latter because the findings of genetics just concretised and further developed Darwin's findings. In the words of one respondent 'the theory of evolution offered some totally new knowledge, while with genetics, we always knew that there was a mechanism that allows us to pass our qualities onto our children, and genetics just helped us to work out what exactly this mechanism was.' Some interviewed scientists noted that one of the most important cultural implications of genetics was that it was helping to reconstruct the history of human migrations though this research was not very well known either among historians or among the general public.

A number of respondents linked genetics and religion. One of them was a practising Christian who said that his work confirmed to him the idea of intelligent design. As he put it, it was difficult to imagine how biological processes worked without

it. Others mentioned that though they themselves were secular and did not believe in God they could see how discoveries made in molecular biology could be interpreted as supporting the idea of intelligent design. They also cited cases of people they knew becoming religious after they started studying molecular biology.

Several medical geneticists stressed that there was no such thing as one 'universal' conceptual impact of genetics and that people from different cultures were bound to give genetic findings different interpretations. One person who had patients from a variety of ethnic groups said that from her experience people from different backgrounds could have a wide range of views of DNA studies and that a good knowledge of different religious cultures was essential for an adequate practice of medical genetics. Another practitioner observed that one of the things that she liked most about working in genetics was that this was a science which had an interaction with philosophy but she also felt uncomfortable about giving any definitive answers about the impact of genetics on human self-perception:

> Has it [genetics] changed the way we see ourselves? It is a huge question. It has to have done… It makes in some ways you feel less in control of what you are as individual because genetics shows that there are control issues which are beyond yourself … On the other hand I think it has no effect at all and it depends on the culture from which you come… So I don't think that I know the answer …that is the bottom line.

She added that her job had taught her to be understanding of a variety of interpretations of scientific research and its application no matter how different they were from hers as she had to deal with a very diverse community of patients. When I asked her whether most of her colleagues felt this way she said that there were more scientists interested in what genetics meant to mankind among medical geneticists who worked in the clinic than among those who never had to leave the lab though there was a big spectrum among them too.

Some geneticists involved just in basic research were not keen on making any sweeping generalisations about the conceptual implications of genetics either. When I

asked one scientist what in his view the impact of genetics on worldviews was he was rather surprised at the question:

> Whose worldviews are you talking about? There are all sorts of worldviews out there just like there are many religions. So, we can only talk about whether genetics has influenced Christian worldview or Muslim worldview or Hindu worldview… It is difficult for me to judge… I think I can only talk about whether genetics has influenced the philosophy of science. I think it definitely has. But then there are so many philosophies… Materialist, idealist philosophies… Which philosophy are we talking about? I am not a philosopher, so it is difficult for me to say. I think that genetics has definitely influenced science… Has it had any conceptual implications for physics? I think I can only say that it had conceptual implications for biology.

Some respondents not only refrained from commenting 'too much' on the cultural implications of genetics but even stated that scientists were the wrong people to ask. Thus one interviewee argued that scientists could only make cognitive claims regarding the object of their study and should not interfere in the subject matter of, for instance, historians, 'Scientists have got the best methodology available for the study of their subject matter and, similarly, historians, have the best methodology available for the study of history.' Another respondent stressed that some people could be excellent scientists in the sense that they would be producing very rigorous research and at the same time be biased and irrational when asked about issues outside of their area of expertise. He even observed with regret that distinguished scientists, Nobel prize winners, for example, were often asked to comment on social and cultural issues though they had nothing valuable to say.

At the same time, several respondents stressed that the developments which occurred in genetics **after** Mendel and Morgan, from the discovery that the hereditary material was in DNA to the completion of the Human Genome Project, hardly had any broader conceptual implications for society whatsoever. They argued that these were just technological advances which had a colossal impact on medicine, various social policies

and practices but had nothing to offer philosophy. Other respondents observed that reproductive technologies stemming from molecular biology and the possibility of genetic engineering on human beings did generate a lot of discussion in the public domain about biosciences redefining the concept of being human, however, they stressed that these 'implications' existed mainly in people's minds and were a matter of politics and not of science. Two respondents even argued that as far as genetic engineering was concerned scientists were not doing anything 'revolutionary', anything that could not have happened 'in nature' anyway. One scientist, who was also very critical of the public perceptions of genetic engineering, said that she was amused at how much importance people were ascribing to 'human' DNA without appreciating the fact that it was 'the same DNA as in other species'. In her experience, lay people tended to think that human DNA was bound to be special and experimenting with it was sacrilege.

Other respondents did not dismiss the importance of the cultural implications of genetic engineering and other technologies associated with genetic research, particularly those resulting in reproductive technologies, however stressed that though such technological advances were likely to affect the debate about what it means to be human, this debate was bound to be divorced from the actual science, with different participants in the debate making of scientific facts whatever they wished. Though they themselves would prefer not to take up any particular position on the question and argued that it is up to the general public, humanities scholars, social scientists and policy makers to ascribe particular meanings to genetics and to construe its conceptual implications, they were wary of the possibility of misusing science. This is how one of the interviewed scientists illustrated his feelings about it:

> One of these earliest debates [about the implications of biotechnology] centered very largely on the question of whether a fertilized egg less than 14 days old began to transcribe its own RNA from its own genes. The argument that was being made was that as long as maternal RNA is being used to make the proteins of which this thing is growing, you could not regard it as an independent being but that independence came with the initiation of RNA transcription. The idea that someone could seriously put forward the idea that

> you could define the person on the basis of RNA prescription struck me as pretty bizarre, really, pretty bizarre!

Almost every interviewee expressed concern about lay people misinterpreting science. The same respondent who observed that scientists were not always the best people to advise on social issues, was at the same time rather critical of the attempts of some commentators coming from outside of science to give scientific facts various cultural meanings to support their social assumptions:

> People could always find what appeared to be very good arguments from sex chromosomes related things, as to why this supported the assumed correctness that women were inferior in most things. In recent years the actual observations, particularly education, have changed, and now you look in the newspapers and people are worried about why are boys doing much worse than girls. You could then start to bring out exactly the same apparently but not scientifically based arguments in terms of the sex chromosomes that we used to support the opposite thirty years ago. Now people look at why boys are doing much worse, and obviously you got one X chromosome, all these genes for intelligence are on X chromosomes, the woman has two.

One geneticist admitted that when invited to conferences devoted to the social implications of genetics he would often accept the invitation just to correct the misconceptions that the speakers might reveal. Two respondents were very appreciative of the importance of the disciplines of the history and philosophy of science provided it was done by people who 'knew their science' and preferably were scientists themselves. Other respondents did not demand of science studies scholars formal training in science but argued that they should work in collaboration with scientists. The geneticists I interviewed in Russia were particularly wary of the danger of subjecting science to an ideological agenda referring to the tragic history of genetics in the Soviet Union.

Many respondents expressed a very strong commitment to bringing benefit to society and some were convinced that to be able to do this scientists had to be aware of humanitarian issues that may stand behind their research. One respondent observed that like all scientists geneticists were driven by a desire to know how a particular part of the world worked, but unlike, say, astronomers all biologists realised that their research had a lot of potential to bring people direct benefit. Another geneticist suggested that because science had lots of practical applications the definition of the goals of scientific research largely depended on society:

> I think most scientists I know want to make an impact, they want to do something important and make an impact on that generally for the good of the world. So I cannot see how broad based understanding of the humanities, culture, and history would not be useful for each of us forming our judgment as to what is important.

At the same time when it came to interpreting the conceptual implications of science he felt that if the task was to be delegated to non-scientists at all it could only be the philosophers of science who were well acquainted with the subject matter.

> So does genetics impact philosophy? I think at the highest levels philosophy is a great discipline where the best practitioners are deeply schooled in the principles of science that relates to their work. It seems to me though that the general public's use of the philosophy when describing scientific issues is largely ignorant of any of the underlying science. I think this must be great source of frustration to the philosophers as it is to the scientists.

Finally, when asked about what is so special about genetics and why they think it figures so prominently in the public discourse, many respondents argued that it was again due a lack of knowledge of the subject among non-specialists. Most interviewees agreed that it was not surprising that life sciences were popular and often made newspaper headlines because it was a vibrant area of research which was promising

significant advances in health care. However, they all stressed that these days the boundaries between genetics and other life sciences such as biochemistry, molecular biology, embryology, etc. were very fluid, there were numerous cross-overs between them and 'genetics' had a special status mainly in public imagination with people calling 'genetics' everything related to biotechnology including stem cell research, IVF treatment, pre-natal diagnostics, cloning and GM food. The reason for that quoted by several respondents was that the word genetics, unlike biochemistry and molecular biology, had a solid historical baggage of meaning for lay people.

Some respondents were particularly concerned with what one of them called 'poor PR' that genetics had because of its association with eugenics. Many were not happy with the way genetics was portrayed in the mass media which in their view stressed either the worst possible outcomes of genetic research or described genetics as a solution to all problems. In both cases, according to my respondents, the press tended to be far too deterministic about the role of inheritance. At the same time two interviewees suggested that often scientists themselves were guilty both of promoting genetics as a special high powered science and of taking advantage of genetics being fashionable by using the word unnecessarily when setting up research projects and applying for funding.

Conclusion

It appears that on the whole my respondents were very open to discussion involving multiple interpretations of the cultural significance of their work and were generally happy to engage with philosophical issues. I would suggest that when talking about their own understandings of the conceptual implications of genetics the interviewees revealed a wide range of approaches, which were present in the answers of scientists from each country where interviews were conducted. As shown above, some of them argued that the current state of research in molecular biology does not go against the idea of intelligent design. Some suggested that it could support a variety of interpretations. Others revealed a covert suspicion of conceptual analyses of most genetic discoveries and were confident to express their views on the implications of genetics' achievements for the concept of being human only in those cases where these

implications were very clear and almost universally recognised (i.e. that our physicality was at least partly predetermined genetically and that the nature of inheritance was particulate). Though on the face of it these respondents were happy to let humanities scholars, social scientists and general public to 'get on' with philosophising about genetics they were also distinguishing between the 'real' and the 'imaginary' philosophical implications of genetics. The 'real' ones in their view are the implications which are based on scientific facts and have a clear meaning. The imaginary are those which represent just some of the numerous possible conflicting interpretations of these facts. As it was observed in one of the interviews quoted above, the suggestion that DNA coded for RNA and RNA coded for protein did not necessarily provide any obvious insights into what it means to be a separate organism, leave alone into what it means to be human.

I suggest that these responses are characterised by a tension between the view that scientists and society should avoid giving scientific discoveries too much philosophical meaning and focus on scientific research satisfying people's 'material' rather than 'cultural' needs and promoting a very specific, often reductionist understanding of the philosophical implications of genetics. In other words, under the pretext of refraining from ascribing genetic advances any meaning at all they actually argued that what these advances meant was that molecular biology had demystified the concept of human physicality.

At the same time most respondents, regardless of their own views of the question, were happy to recognise that different social and cultural communities may have different interpretations of the discoveries made in genetics. Nobody claimed that scientists had a monopoly on the knowledge of what it means to be human and many demonstrated a stronger commitment to the idea of discovering how the material world works rather than to solving 'the mysteries of life'. However, practically all respondents were concerned about non-specialists misrepresenting science in their discussions of the cultural meanings of genetics. Thus I would suggest that my interviewees were shifting between recognising that multiple interpretations of the philosophical implications of their work were possible and that scientists were not the only and sometimes not even the best candidates for the job of discerning philosophical significance of their research on

the one hand and an urge to make sure that these interpretations were based on 'correct science' on the other.

It should be noted in this respect that in the interviews the respondents were asked also about their view of the impact of culture and society on science. Their answers to these questions were much more homogenous, as every person argued that culture could hardly affect scientific methodology.[1] When answering questions about the conceptual implications of genetics most respondents also stressed that once the 'concrete scientific facts' had been established they might be ascribed a variety of cultural meanings. However, what was important is to make sure that any prior cultural presuppositions does not affect the processing of establishing these facts.

To conclude, it appears that there is a lot of interest among molecular biologists and geneticists in establishing a dialogue with humanities scholars and the general public where scientists would be correcting various misrepresentations of scientific facts. At the same time as far as the interpretation of the conceptual implications of genetics is concerned there is hardly any ground for talking about a dichotomy between 'scientific' and 'non-scientific' views. Not every scientist would sign up to James Watson's perceptions of the meaning of genetics and, as was shown, the views that interviewed scientists had on the subject, were sometimes diametrically opposite.

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[1] The results of this part of the study will be presented in a separate paper.

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